Yasuhisa SAIKI*: The Attempt on Classification of Japanese Monkshood.

斎木保久：日本産トリカブトの分類の試み

Japanese monkshood (*Aconitum*) is one of the most difficult groups taxonomically, hitherto many species were recorded by THUNBERG, LÉVEILLÉ et VANIOT, FR. SCHMIDT, NAKAI, KOIDZUMI, TAKEDA, MIYABE et TATEWAKI, TAMURA et NAMBA and TOYOKUNI. Especially, NAKAI devoted his efforts to the classification in his long studious life. About 60 species, except group of *Lycoctonum*, were arranged at clean system in his paper[1] which was published after his death. Moreover, he distinguished several species of nude names on some specimens that stored at Herbariums of Tokyo University and National Science Museum of Tokyo, therefore about 70 species were classified in the case containing of several overlooked and neglected species by him in the last paper. His work contains many confusions and is quite mechanical and artificial as pointed by TAMURA et al.[2]

Recently, TAMURA and NAMBA[2] restudied on classification of *Aconitum* in Japan, and recognized, 30 species and 21 varieties by addition of several new species. Their theory was produced as the results of many observations in wild states, and approached to natural system as compared with NAKAI's system. However, any confusions and mechanical parts were remained still in their system. So, the individuals forming one colony are devided as another species occaisionally still, for a few criterias, especially the features of hair at pedicel[3], carpella and filament, used by them have inconstant characters within same species. Furthermore, their conception of species is too minute, mechanical and obscure, accordingly their classifcation recognizes too many species in narrow area.

The author has collected and observed Japanese monkshood from 13 years ago, and has arrived to the opinion that the classification consists of quite few species resultly.

Trial of the classification on Japanese Monkshood

As TAMURA and NAMBA's[2] expression, *Aconitum* of Japan are very variable and have not clear criterias on the classification. The fact is remarkable in productive organs such as flower and fruit. on the contrary the forms of leaves seem to be constant comparatively, however the latter features are not basic taxonomically.

Indian monkshoods illustratrated by KIRTIKAR and BASU[4] have clear distinctions

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among species, and these distinctions cause to several criterias namely axillary inflorescentia, incission of leaf, shapes of calyces and nectarium, forms of cambium ring on tuberous root and hair of pedicel and carpella, especially shapes of nectarium are remarkable distinction among species. Therefore these criterias have values to be applied in the classification of Japanese monkshood, actually distinctions among Japanese kinds are hardly recognized on these characters in the most cases. And then, the author intends to recognize distinction between another species by discontinuous gaps of many features through the studies on total judgement of outernal appearences and geographical considerations.

Actually, Japanese monkshood is considered as followingly. In incissions of leaves there is a tendensy that becomes shallower gradually as the habitates moving from southern region to northern one in the case of the kinds typed ***Aconitum japonicum*** THUNB. Combined with the natures of pedicels, the states are shown at Chart 1 in same typed plants. Furthermore there are many intermediate forms, classified as many species in past, among these kinds. So the differences among these kinds are conisdered to be continuous.

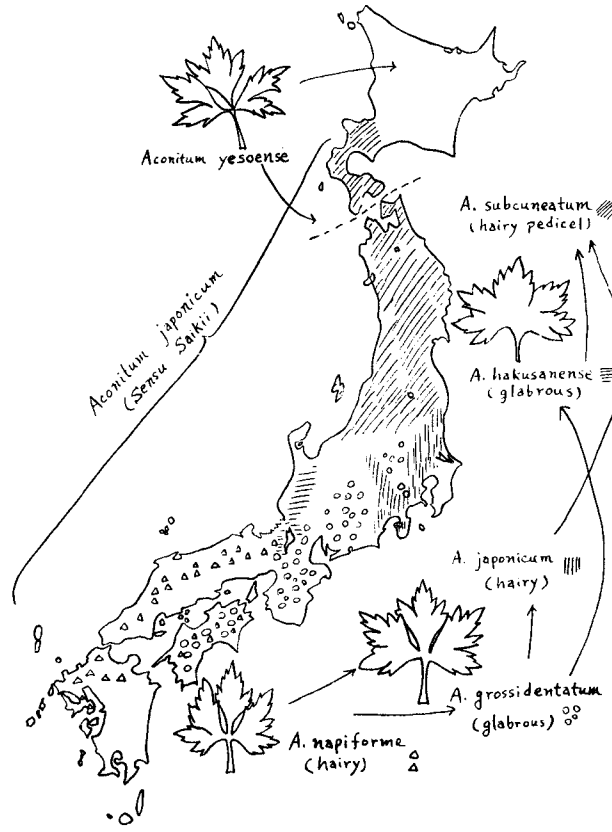

Chart 1. Correlation of the localities and the outernal appearences on group of Aconitum japonicum (Sensu Tamura et al. i). The scientific names of each kinds are shown by Sensu Nakaii.

However ***Aconitum subcuneatum*** NAKAI (sensu Nakaii), distributing to the most northern region in this group. differs appearently from ***Aconitum yesoense*** NAKAI distributing widely in Hokkaido district (Yezo) on outernal appearences. On the contrary, ***Aconitum yesoense*** is resemble to ***Aconitum napiforme*** LÉV. et VAN. (snesu Nakaii. and Tamura et al.) distributing to the most southern region of far distant places. Then, the discontinuity among ***Aconitum yesoense*** and many kinds of ***Aconitum japonicum*** group are recognized, therefore these many kinds of ***Aconitum japonicum*** group assume to belong to only single species and are each local varieties that are in the process of specific evolution, besides are distinguished clearly from ***Aconitum yesoense.***

Alpine species vary continuously by growing altitudes, as shown at Chart 2, and this fact is observed at Mt. Shirouma recorded many species. The extreem type

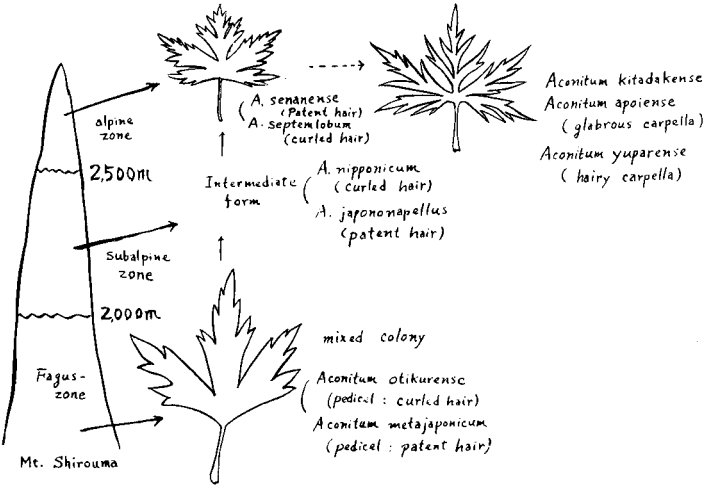

Chart 2. Correlation of the growing altitudes and the outernal appearences on alpine kinds.
The scientific names of each kinds are shown by Sensu Nakaii.

called ***Aconitum kitadakense*** NAKAI is connected by intermediate form to usual alpine species ***Aconitum senanense*** NAKAI at a colony in Mt. Kitadake, besides this extreem type is almost indistinguishable on outernal appearences from ***Aconitum apoiense*** NAKAI except the distribution, however both kinds are thought to belong to same species as conceiving of analogy with distribution of ***Callianthemum*** at both habitats. Then Japanese alpine species belong to single species, for several kinds of Hokkaido, recorded hitherto at another regions, have not clear distinctions to be devided species. Therefore, local varieties and forma in single species are recognized

in the case of alpine monkshoods.

From thus analogies, Japanese monkshoods are devided to quite few species that are variable and consist of many local varieties, intermediate forms and extreem forms. Then only 6* species are recognized and are related each other. Hitherto, all Japanese species were treated as endemic plants in this country and were deduced to be clearly different from foreign species. However, it is suggested that all criterias used on classifications of foreign species may not poccess of heavy senses in the most cases. Therefore, any Japanese plants are doubted to be different species with foreign ones. The scientific names of Japanese monkshoods must be reexamined with comparison of foreign kinds, especially of India, China, Korea, Siberia and other surrounding area of Japan. Although this reexaminations exhaust long times and much exertion. Accordingly, the author intends to study on this problem hereafter.

So, each species are arranged tentatively by previous scientific names reported as endemic plants of Japan in this paper.

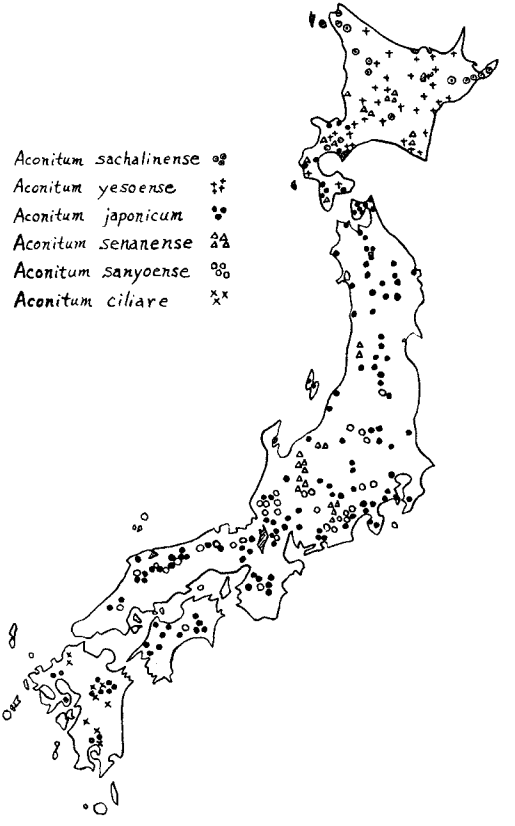

Chart 3. The distributions of Japanese monkshoods.

1) ***Aconitum sachalinense*** Fr. Schmidt in Reisen in Amurl. u. Sach. 107 (1868); Nakai in Bot. Mag. Tokyo 22 : 134 (1908).

This species is characterised by the features of 5-sectioned and lineary incised leaf and of long infinite inflorescentia, and

* Recently, a speies of yellow colored flower was discovered by Mr. K. Hosoi.

is resemble to a certain type of *Aconitum napellus* LINN. in Europe, must be compared each other. *Aconitum ito-seiyanum* MIYABE et TATEWAKI seems to be the extreem form characterised of hairy carpella and differentiated in serpentine region, probably is not to belong to another species.

This species contains mainly very toxic alkaloid jesaconitine[5] and weakly poisonous kobusine,[8] and is allied to the next species chemically.

Distribution : Hokkaido, marshy places of lowland at northern and eastern regions; Sachalin.

Japanese Name : Karafuto-bushi.

var. ***compactum*** MIYABE et TATEWAKI in Trans. Sapporo Nat. Hist. Soc. 13, 106 (1934)

This variety is characterized to be small size, to possess of only terminal inflorescentia and to be more hairy in comparison with the mother species.

Distribution : Hokkaido, meadows in alpine zone at Rishiri and Rebun islands. Endemic.

Japanese Name : Rishiri-bushi.

2) ***Aconitum yesoense*** NAKAI, in Bot. Mag. Tokyo 22, 136 (1908)

This species is characterized by 3-sectioned leaf with petiolate leaflets generally, and is variable species on outernal appearences by growing circumstances. The chemical conponents vary in each localities from very poisonous to non-toxic, usually jesaconitine[5] (toxic substance) and kobusine[8] are contained.

Aconitum misaoanum TAMURA et NAMBA seems to be the local variety differentiated in Shiretoko Peninsula, and is not thought to belong another species.

Distribution : Hokkaido, forests and meadows in whole region,

Japanese Name : Ezo-torikabuto.

3) ***Aconitum japonicum*** THUNBERG in Fl. Jap. 231 (1784).

Aconitum subcuneatum NAKAI

This species is quite variable, and may be devided to many regional varieties, usually possesses of definite inflorescentia. Its leaves show variable incisions. Many local varieties are connected each other by intermediate forms.

Distribution : Hokkaido, forest in lower parts of southern region; Honshu, Shikoku and Kyushu, forest in lower～subalpine zones of whole regions.

Japanese Name : Yama-torikabuto (wide sense).

var. ***japonicum*** THUNB.

A. subcuneatum NAKAI, *A. iwatekense* NAKAI, *A. Okuyamai* NAKAI, *A. hisautii* NAKAI, *A. tashiromontanum* NAKAI*

* Synonym is shown in the case differing with TAMURA's opinion.

This variety is characterized by shallowly incised and hairy pedicel of flower. The scientific name owed to TAMURA and NAMBA's endeavours. This variety contains toxic substance jesaconitine[5][6] as specific feature usually, however the chemical compositions are variable in each localities and toxic substances are not detected occasionally.[6]

Distribution : Hokkaido, south-western region; Honshu, northern region mainly northern from Niigata and Fukushima Pref.

Japanese Name : Oku-torikabuto.

var. ***hakusanense*** (NAKAI) SAIKI comb. nov.

A. hakusanense NAKAI in Bot. Mag. Tokyo **25**, 53 (1911)

A. hokurokuense NAKAI, *A. ibukiense* var. *eizanense* NAKAI

This variety is quite resemble to the former variety, whereas differs at glabrous or nearly glabrous pedicels. Toxic substances aconitine, mesaconitine and hypaconitine[5] are contained and differs from non-toxic *A. sanyoense* NAKAI of resemble species in outernal appearences.

Distribution : Honshu, subalpine~lower parts of central region, mainly in Japan Sea side.

Japanese Name : Hakusan-torikabuto.

var. ***zigzag*** (LÉV. et VAN.) SAIKI comb. nov.

A. zigzag LÉV. et VAN. in Bull. Soc. Fr. **53**, 390 (1906)

A. grossedentatum NAKAI, *A. komatsui* NAKAI, *A. suspensum* NAKAI, *A. sakuraii* NAKAI, *A. kishidai* NAKAI.

This variety is characterized by deeply incised leaf and glabrous or almost glabrous pedicels. The chemical components are homogeneous with the former variety.[5]

Distribution : Honshu, subalpine~lower parts of central and south-western region (Sohayaki component); Shikoku.

Japanese Name : Kawachi-bushi.

var. ***montanum*** NAKAI

A. deflexum NAKAI, *A. momosei* NAKAI, *A. ishizukai* NAKAI, *A. parahakonense* NAKAI

This variety is resemble to the former variety, however differs at hairy pedicels usually. The intermediate form is recorded as *A. ibukiense* etc.

Distribution : Honshu, lowland subalpine forest in south-eastern regions, mainly in Pacific Ocean side. From Ibaragi Pref. to Shizuoka Pref.

Japanese Name : Yama-torikabuto. (narrow sense).

var. ***napiforme*** (LÉV. et VAN.) SAIKI comb. nov.

A. napiforme LÉV. et VAN. in Rep. Sp. Nov. **5**,9 (1908)

A. triphyllum NAKAI

This variety is quite resemble to the former variety, differs only at entirely devided leaf. The chemical constituents consist of mainly hypaconitine.[5)]

Distribution : Honshu, south-western regions; Shikoku and Kyushu, each habitats are lowland.

Japanese Name : Tsukushi-torikabuto.

4) ***Aconitum senanense*** NAKAI in Bot. Mag. Tokyo 22, 139 (1908)

A. nipponicum NAKAI, *A. metajaponicum* NAKAI, *A. otikurense* NAKAI, *A. micranthum* NAKAI, *A. septemcarpum* NAKAI.

This species is characterized by quite hairy stem and quite deep colored flower, whereas is so resemble to the former species occasionally that distinction between both species is difficult, and is very variable by habitual circumstances.

This species distributed mainly in alpine zone and reaches to subalpine zone. This plant is allied to a certain type of *A. napellus* LINN.

Distribution : Honshu, alpine zone of northern and central regions. Curiously, this kind grows abundantly in Hida and Akaishi Mountains, while is absent in Mt. Fuji and Kiso Mountains.

Japanese Name : Hosoba-torikabuto.

var. ***yuparense*** (TAKEDA) SAIKI comb. nov.

A. yuparense TAKEDA in Not. Roy, Bot. Gard. Edinb. 8. 232 (1915)

A. apoiense NAKI, *A. kitadakense* NAKAI, *A. yamazakii* TAMURA et NAMBA.

This variety is characterized by linearly incised leaf and is able to be separated to three forma, recorded as species namely *A. yuparense*, *A. apoiense* and *A. yamazakii*. This plant seems to be prototype of the former species.

Distribution : Honshu, Mt. Kita-dake ; Hokkaido, alpine zone.

Japanese Name : Ezo-hosoba-torikabuto.

5) ***Aconitum sanyoense*** NANAI in Bot. Mag. Tokyo 49, 503 (1935)

A. titibuense NAKAI.

This species is characterized by extreemly glablous body on whole plant and shallowly incised and sunken-veined large leaf. This plant is resemble to *A. japonicum* var. *hakusanense* on outernal appearences however differs at glabrous vein and obtuse dentation. On the mixed colony with *A. japonicum* var. *montanum*, their intermediate form does not appeare.

This plant contains non-toxic alkaloids hypognavine etc.,[7)] and is one of non-poisonous monkshoods.

Indian non-poisonous monkshood, *A. palmatum* D. DON is resemble to this kind, needs to compare with both plants.

Distribution : Honshu, temperate zone (1,000m~2,000m at sea levl) of central and western regions; Shikoku.

Japanese Name : San-yō-bushi.

var. ***tonense*** NAKAI

This variety is characterized by densely hairy carpella and axilate bulbilet of leaf. This plant is non-toxic as the mother species however main component is minor alkaloid of the mother plant.[7]

Distribution : Honshu, central region.

Japanese Name : Johshū-torikabuto.

6) ***Aconitum ciliare*** DC

A. japono-volubile TAMURA in Science Rep. 9, 110 (1960)

This species is remarkable by twinning stem and long hair of stem at sprout stage. TAMURA reported as a new species, however, foundation of distinction among Korean species is weak.

This plant contains mainly hypaconitine.[5]

Distribution : Kyushu, central region.

Japanese Name : Hana-kazura.

Discussion and Conclusion

The classification of Japanese monkshoods is quite puzzled. Hitherto, many species were recorded by several botanists,[1][2] however the author recognize only 6 species by adjustment of these many species through studies on outernal appearences and geographical considerations. However, even this classification contains any obscure portions and seems to be far from perfect system. Especially, the relaton of chemical constituents with classification is difficult problem. According to MAJIMA[5], SUGINOME[8], OCHIAI and OKAMOTO[6][7] and their co-workers, the constituents are variable by habitual localities, in even same typed plant, such facts are reported at narrow district as Shimokita Peninsula[6] in Aomori Prefecture. Thus phenomena are not explained in today's stage, so the rule governing chemical components and classification must be investigated chemotaxonomically.

On internal structures of tuberous roots, the author[9] and NAMBA[10] studied systematically, however these structures are quite resemble at each other and strict distinctions are not found usually as on outernal appearences. This fact is deduced that Japanese species are quite related each other and internal structure of root is more indistinctive than feature of aerial part.

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5) MAJIMA, Morio : Nippon Kagaku Kaishi **51**, 200 (1930) etc.

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8) SUGINOME et al. : Proc. Japan Acad. **22**, 119, 122 (1950) etc.

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摘　要

トリカブト類は分類至難の植物群で，これまでに極めて多数の種が記録されている。筆者は，これらを再検討し，6種のみを認め，それぞれの下に地方変種として整理する。

1) カラフトブシ，北海道の湿地に生え，花序が大きく葉が5全裂するもの。変種リシリブシは草原生の小形のもの。

2) エゾトリカブト，北海道に広く分布し葉は三全裂し小葉は有柄のものである。

3) ヤマトリカブト，北海道南部から九州まで分布するもので変異が極めて多い。地方変種としてオクトリカブト（北海道，東北），ハクサントリカブト（本州中部，日本海地方），カワチブシ（栃木県から長野，愛知等をへて四国まで），ヤマトリカブト（茨城県から静岡県まで），ツクシトリカブト（本州西部，四国，九州）に分ける。

4) ホソバトリカブト，高山性の種類で茎が多毛，花の濃色のもの，変異が多い。本州の高山帯に分布する。変種エゾホソバトリカブトは北海道の高山と本州では北岳に産し，葉は極めて細裂する。

5) サンヨウブシ，葉の切れ込みの浅い無毛のトリカブトで本州の中部以西と四国に分布する。変種ジョウシウトリカブトは本州中部に分布し果実に密毛の生えたもの。

6) ハナカズラ，蔓性のトリカブトで九州に分布する。